Update on HCAL Phi symmetry

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Calibration procedure

Corrections are done with mean and with variances

Mean:

$Cor_{ij} = 1/Nj \sum_j (\langle E_{ij} \rangle)/\langle E_{ij} \rangle$

Variances:

$Cor_{ij} = \sqrt{ 1/Nj \sum_j (Var_{ij} - Var_{noise\_ij})/(Var_{ij} - Var_{noise\_ij}) }$

50 ns pileup introduce some changes both in HBHE and HF

Mean:

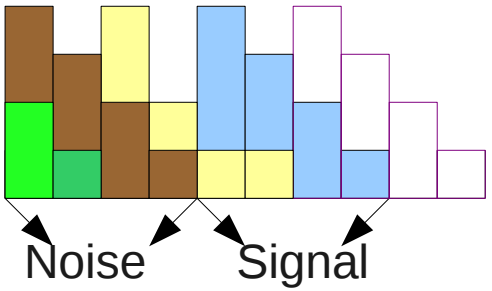
$\langle E_{ij} \rangle = \langle E_{signal\_ij} \rangle + \langle E_{pileup\_ij} \rangle$

Variance:

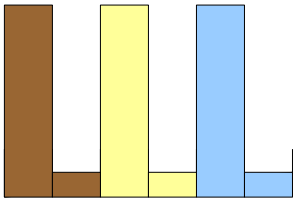
$Var_{noise\_ij} = Var_{real\_noise\_ij} + Var_{pileup1\_ij}$

$Var_{ij} = Var_{signal\_ij} + Var_{real\_noise\_ij} + Var_{pileup2\_ij}$

HBHE (IT and OOT Pileup)



HF (IT Pileup)



Statistics in AlcaRAW/AlCaRECO

POINT A ==========

For signal use /HcalNZS/Run2011A-v1/RAW

Runs:

10 TS in HF: 160404-163869 **HcalRespCorrs_v3.30_TEST**

6 TS in HF: 163869-173692

Use 2 TS in HF for signal and noise reconstruction in ALCARECO processing
Good lumi sections were selected with JSON file:

Cert_160404-173692_7TeV_PromptReco_Collisions11_JSON.txt

2.6 million events

For noise use /TestEnablesEcalHcalDT/Run2011A-v1/RAW
Runs from 164465 to 173692
~2.5 millions events

POINT C ==========

For signal use /HcalNZS/Run2011B-v1/RAW

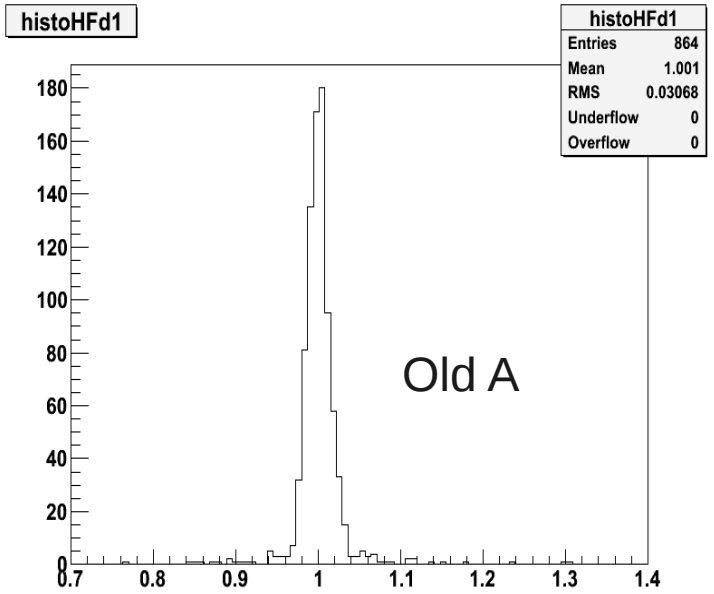
Runs:

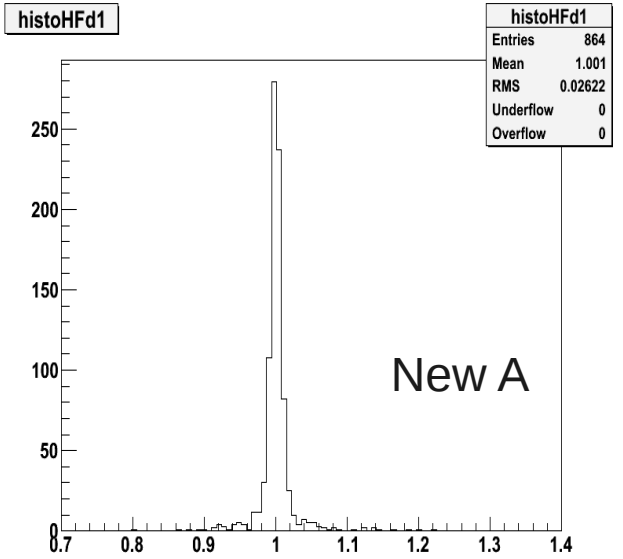
6 TS in HF: 175860-179411

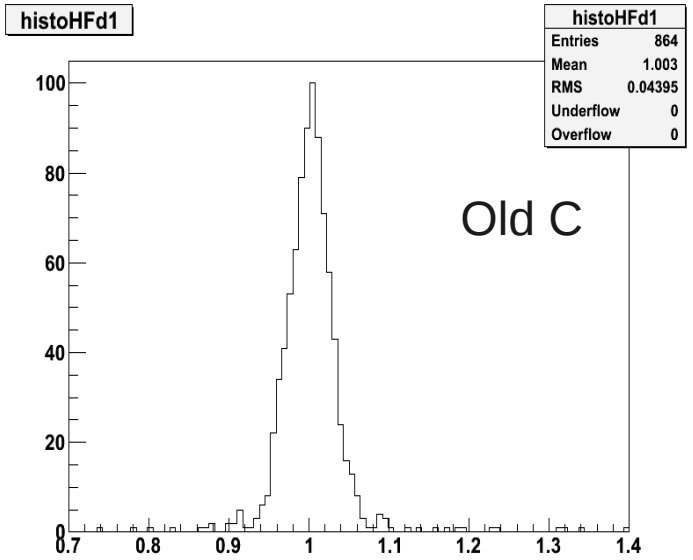
557 Kevents

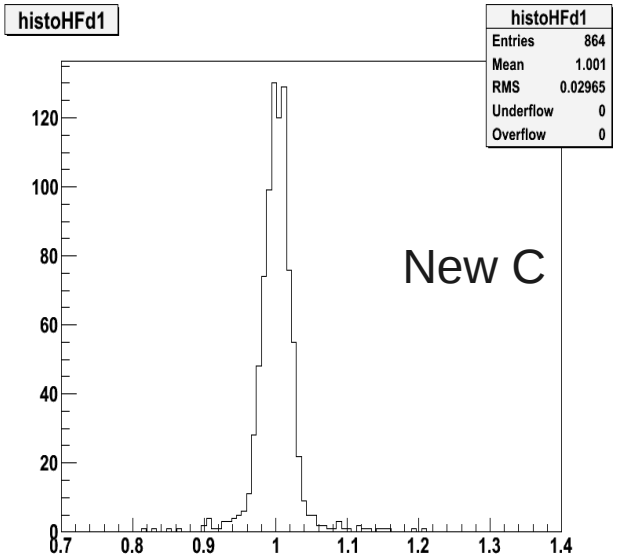
For noise use /TestEnablesEcalHcalDT/Run2011A-v1/RAW
Runs from 175788-180154
~2.3 millions events

Old vs New Noise subtraction: depth 1

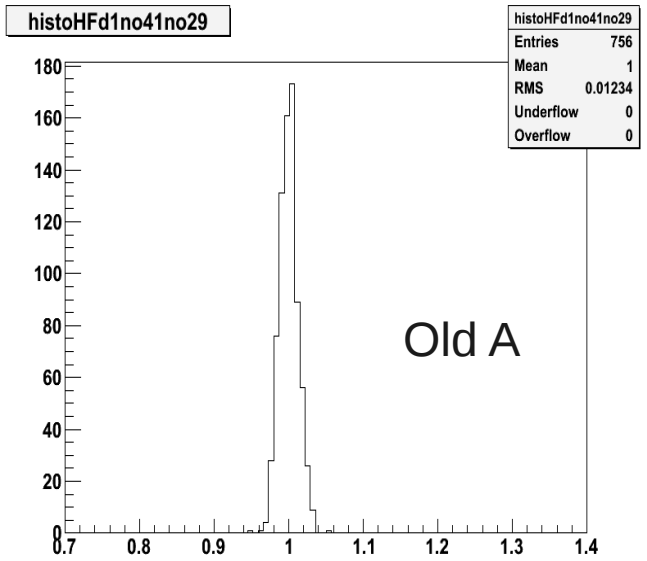


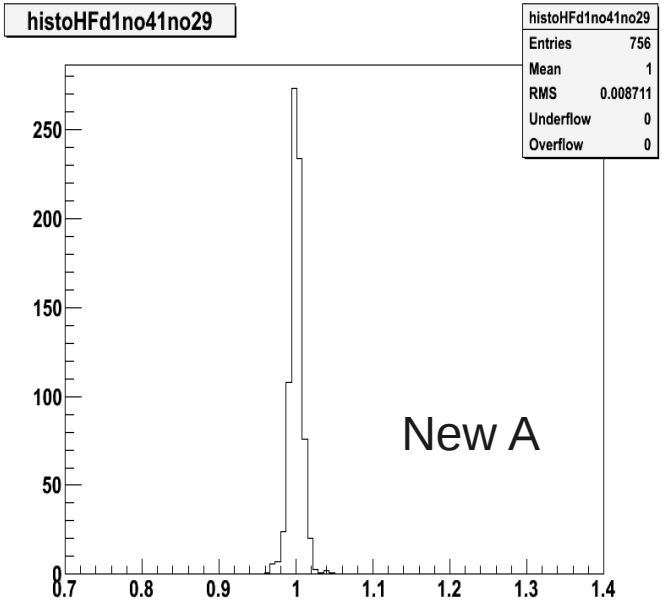


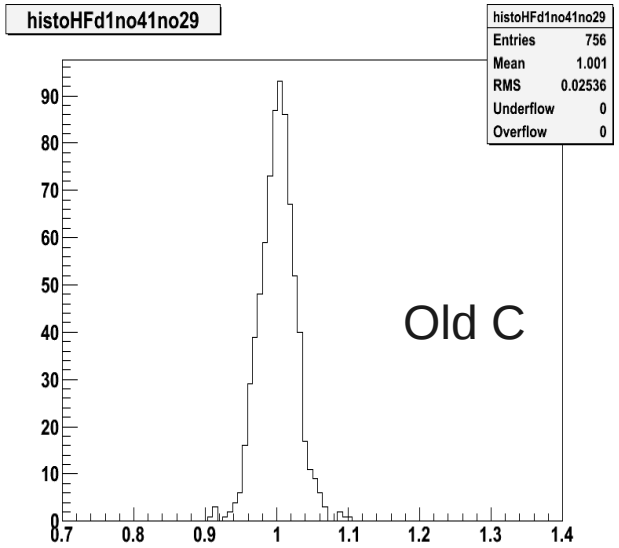


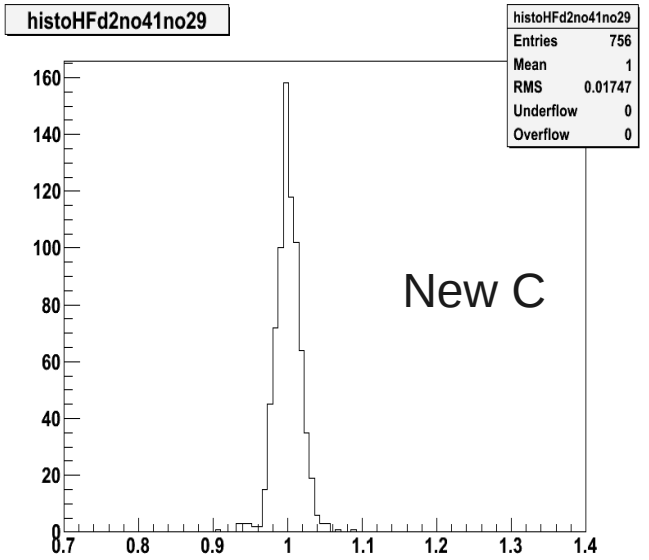


Old vs New Noise subtraction: depth 1, exclude 29 and 41

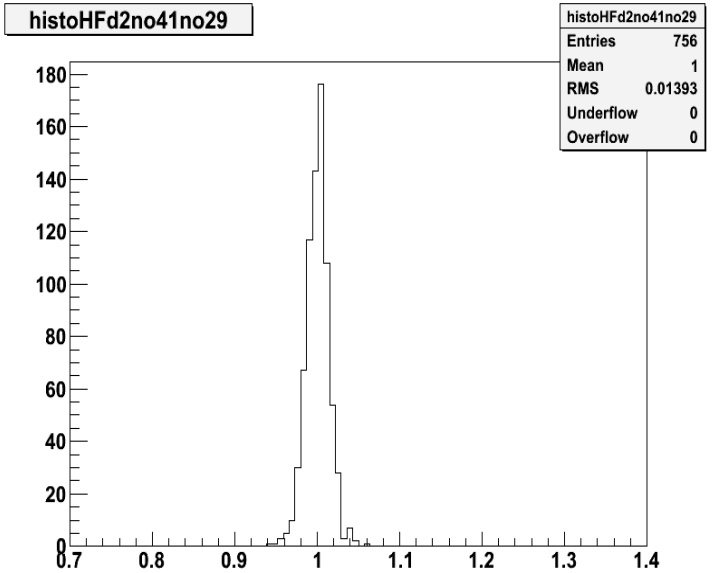


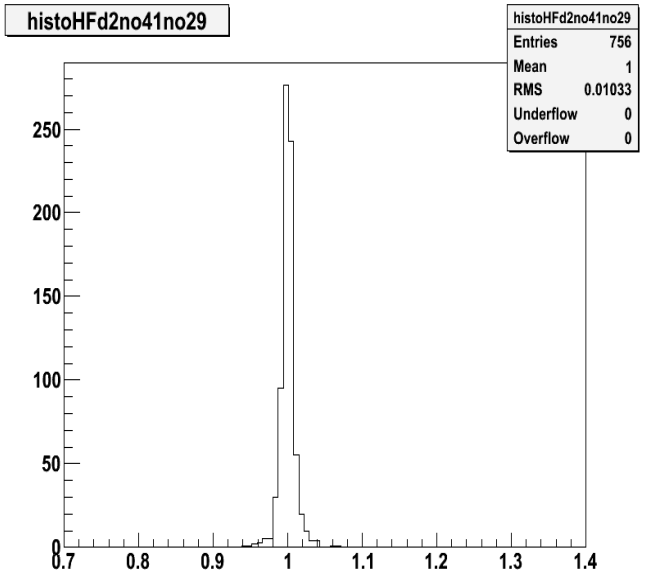


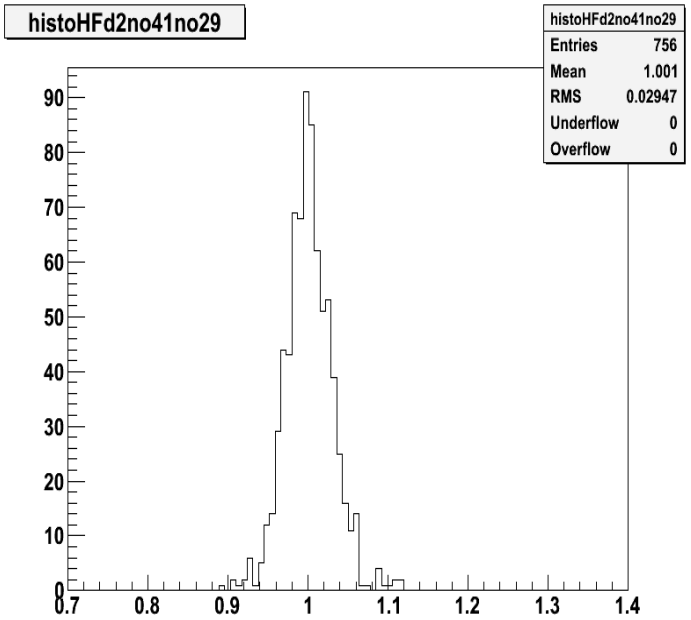


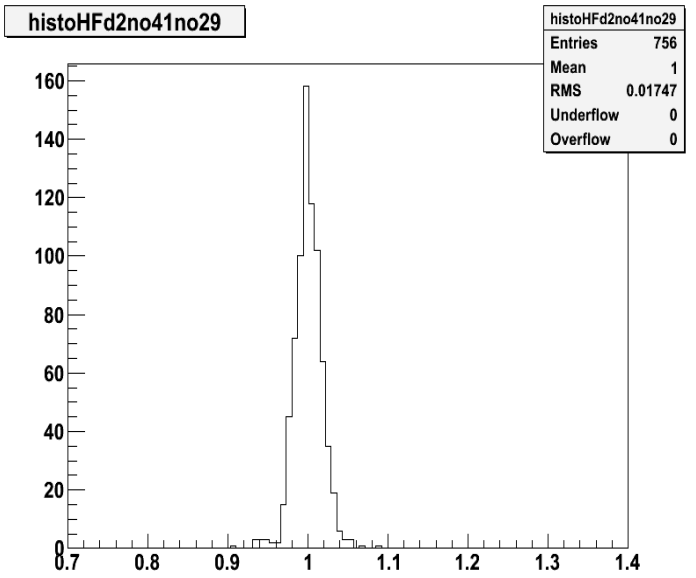


Old vs New Noise subtraction: depth 2, exclude 29 and 41

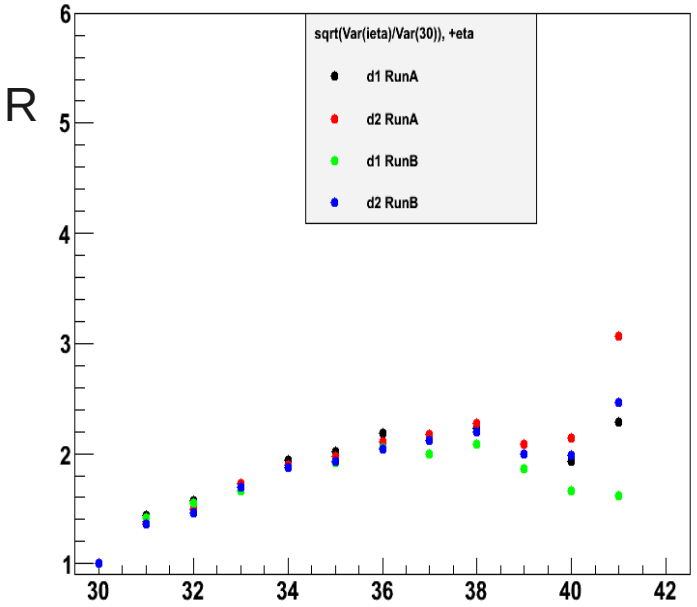


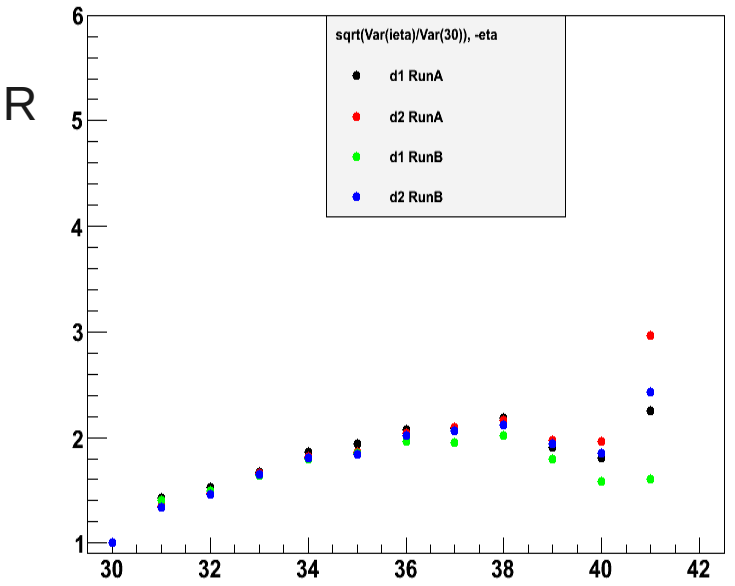






Scale: RunA vs Run B



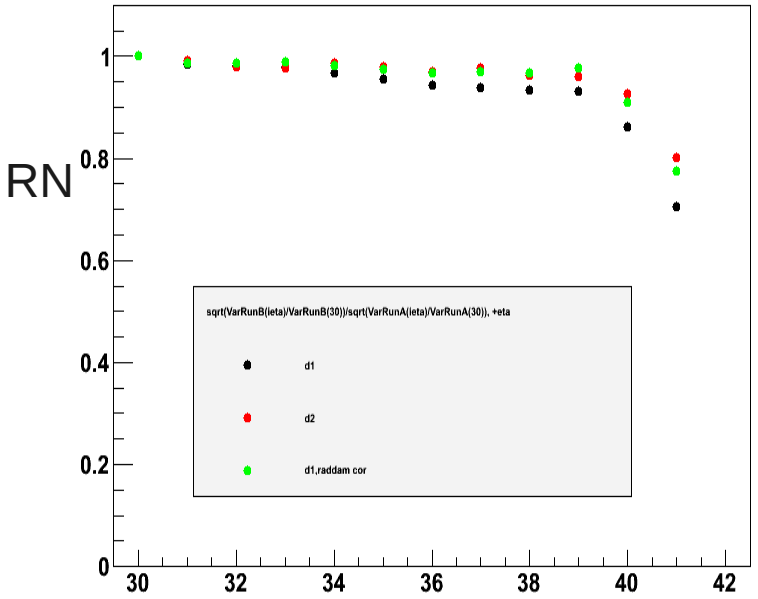


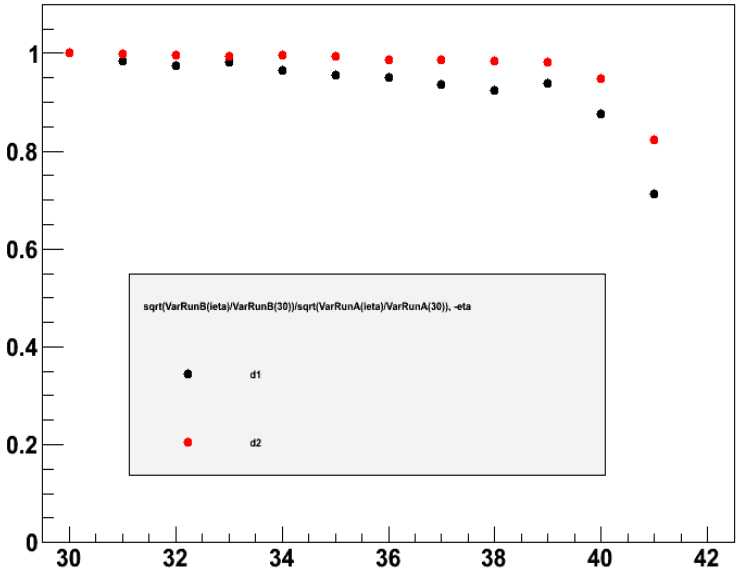
R = sqrt (Var(ieta)/Var(30)) - independent from PU for the first order

Dependence R vs ieta changes between Run B and Run A:

- **Different PU – E(eta) dependence?**
- **Different trigger table – E(eta) dependence?**
- **Raddam**
- **PMT**
- **PMT+Raddam**

Relative Scale: RunA vs Run B

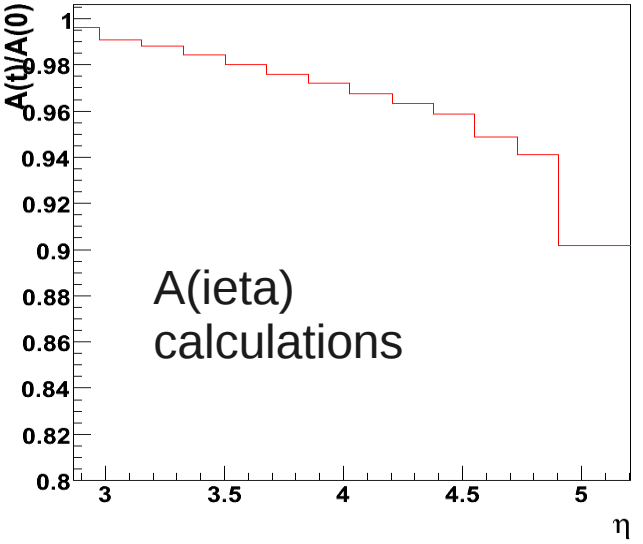




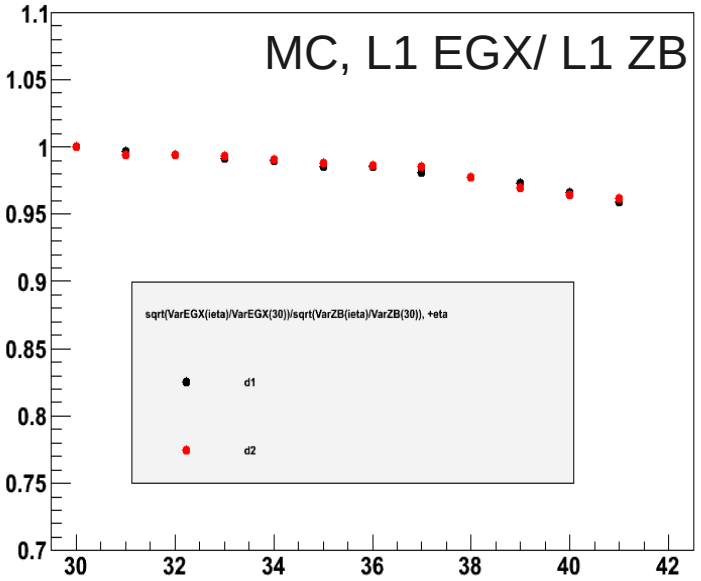
RN = R_C/R_A
R_C and R_A = sqrt(Var(ieta)/Var(30)) for RunB and RunA

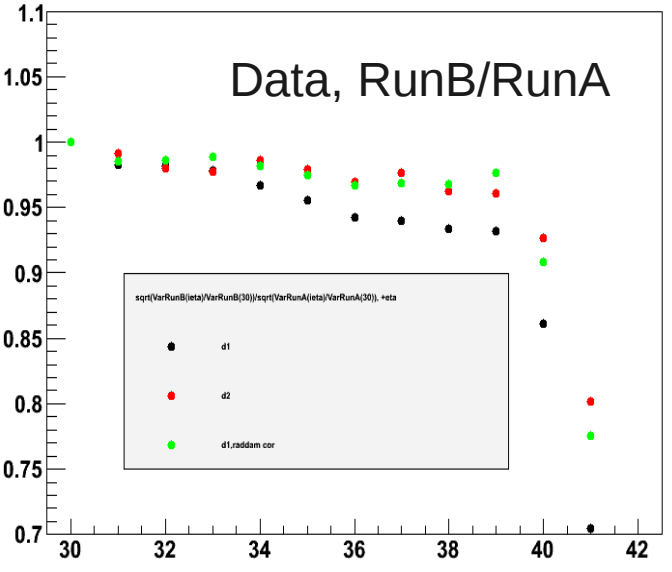
Green points (only for depth=1):
RN = RN*A(30)/A(ieta)

Compatible with raddam curve except ieta=40,41?



PU and Trigger?





MC:

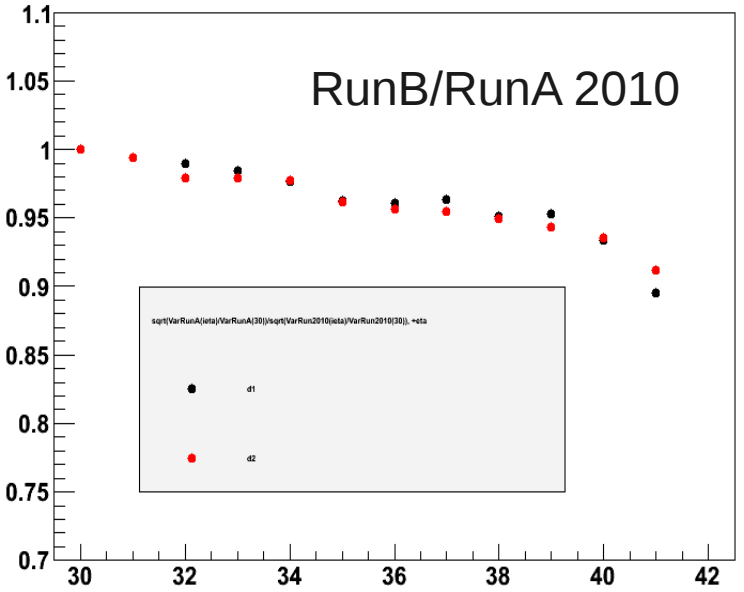
RN=sqrt(VarEGX(ieta)/VarEGX(30))/sqrt(VarZB(ieta)/VarZB(30))

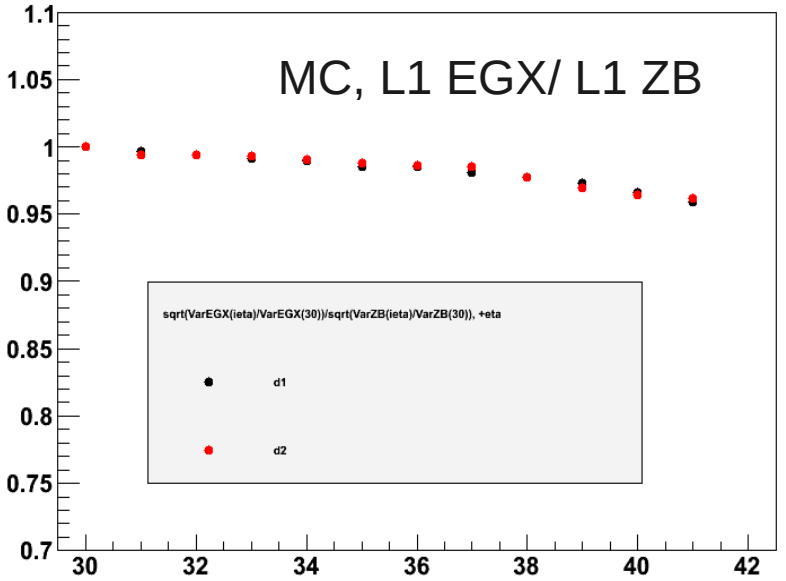
Data:

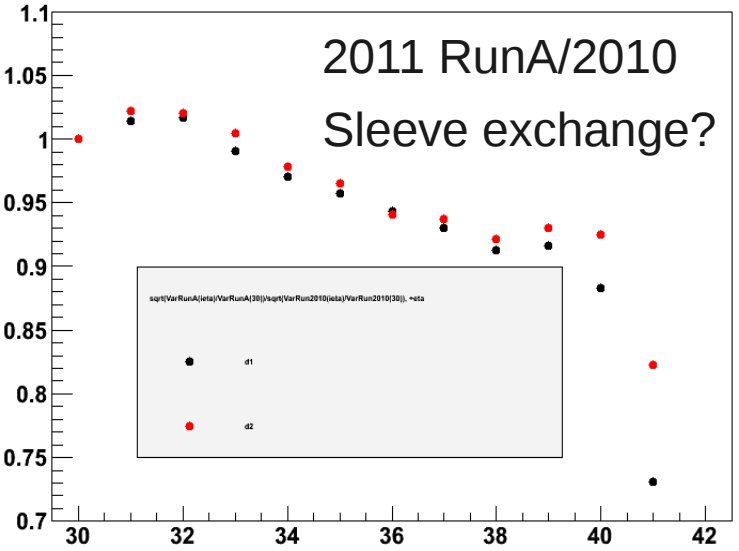
RN=sqrt((VarSig1(ieta)+N1*VarPU(ieta))/(VarSig1(30)+N1*VarPU(30))/
sqrt((VarSig2(ieta)+N2*VarPU(ieta))/(VarSig2(30)+N2*VarPU(30))

Where Sig1 and Sig2 is a set of triggers. If Sig1 not equal Sig2, we will observe some dependency even without change neither in PMT nor in fibers.

RunA vs RunB 2010







Comparing data we can not easily get rid of PU effect and trigger table.

Summary

Visible difference in corrections spread both in depth=1 and depth=2 between RunB and Beginning of RunA.
No difference between changes in coefficients spread between depth=1 and depth=2

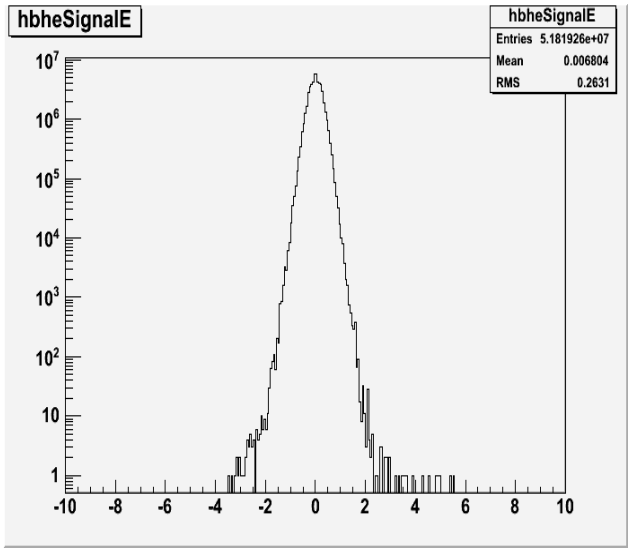
Visible difference in scale vs ieta dependence may be compatible with fiber raddam hypothesis assuming that S and L are affected differently. Eta 40,41?

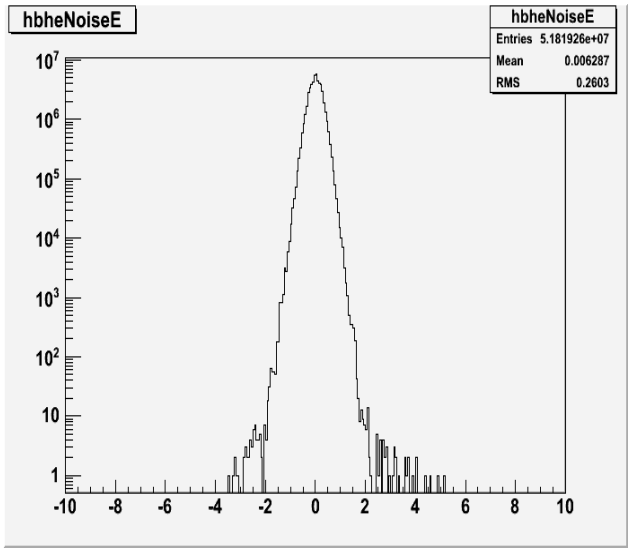
Need to clarify and taje into account:

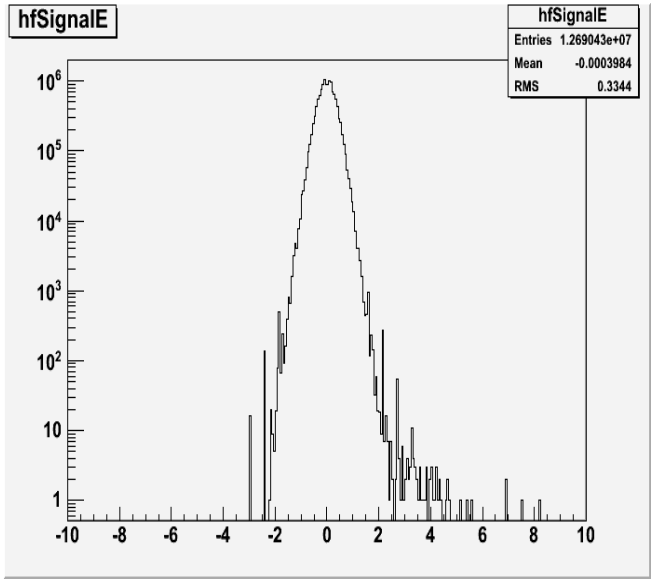
- dependence on PU (E(ieta)
- trigger table

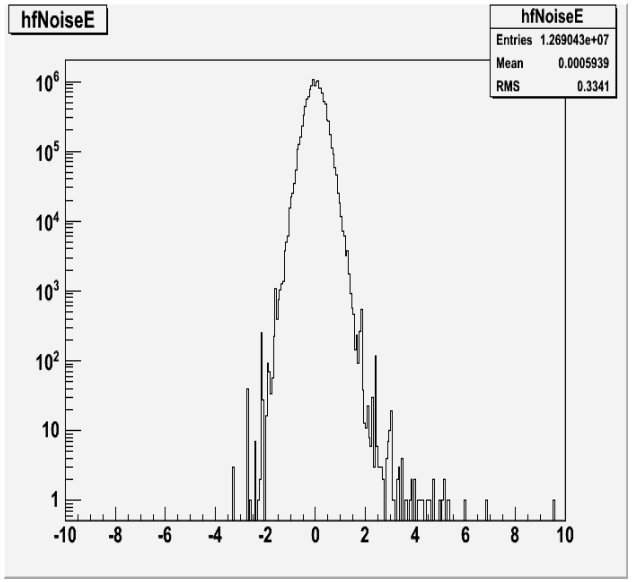
Back-up slides

Pedestal sample

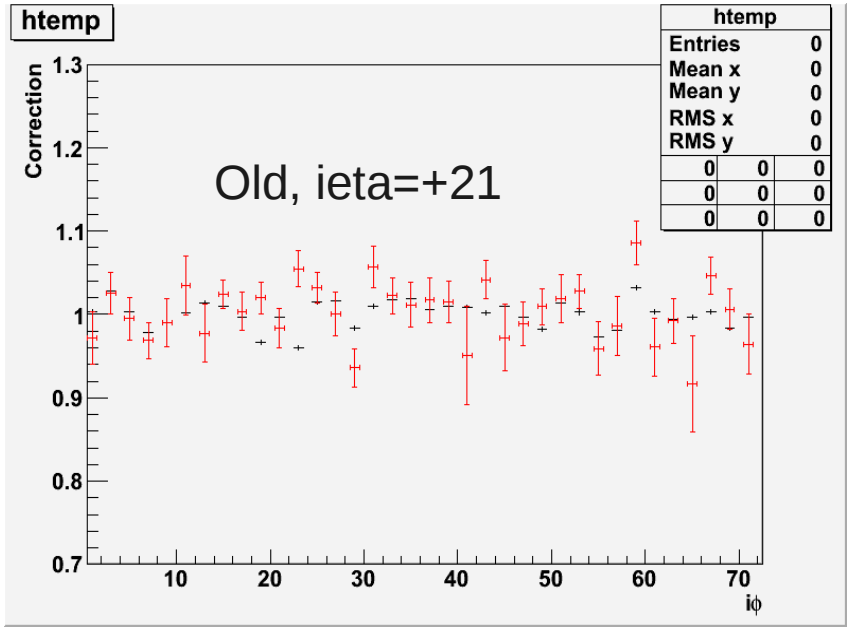


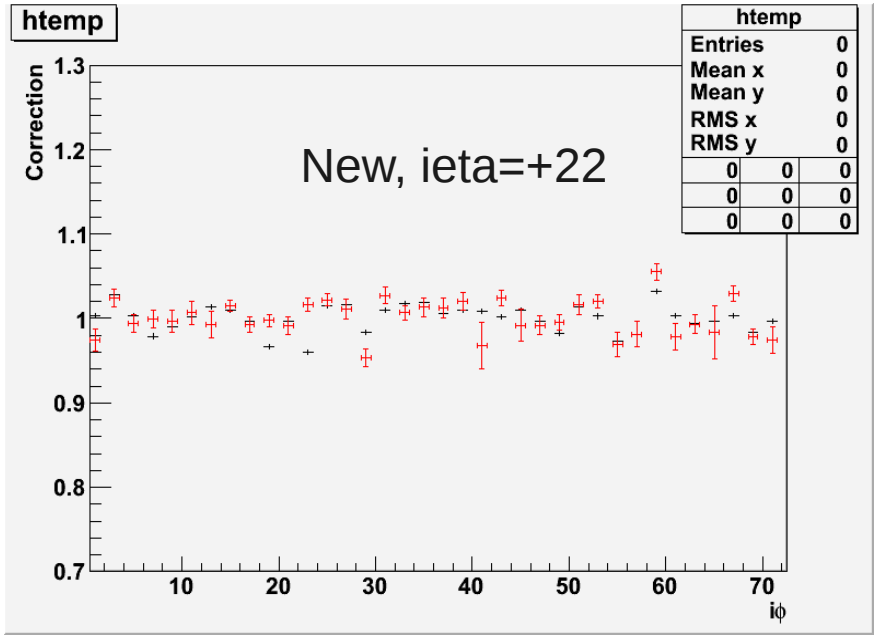


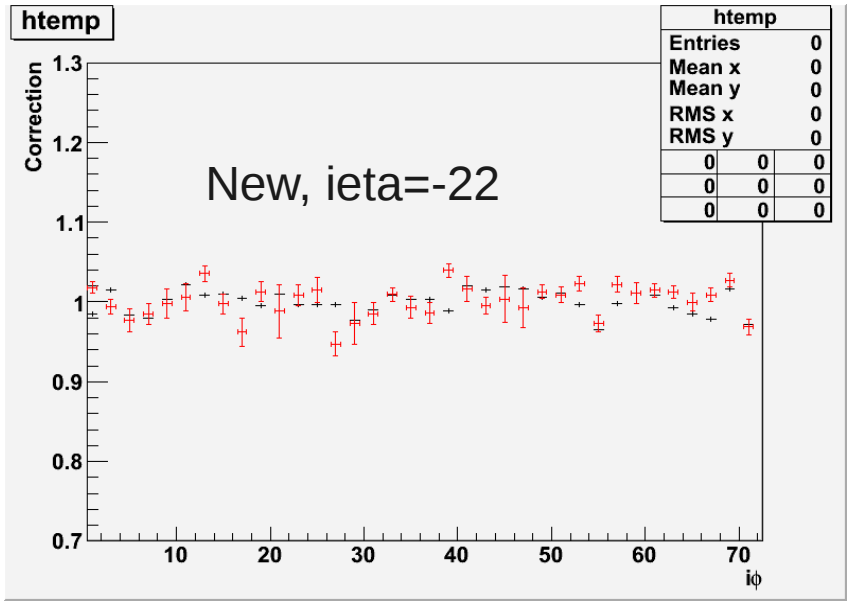


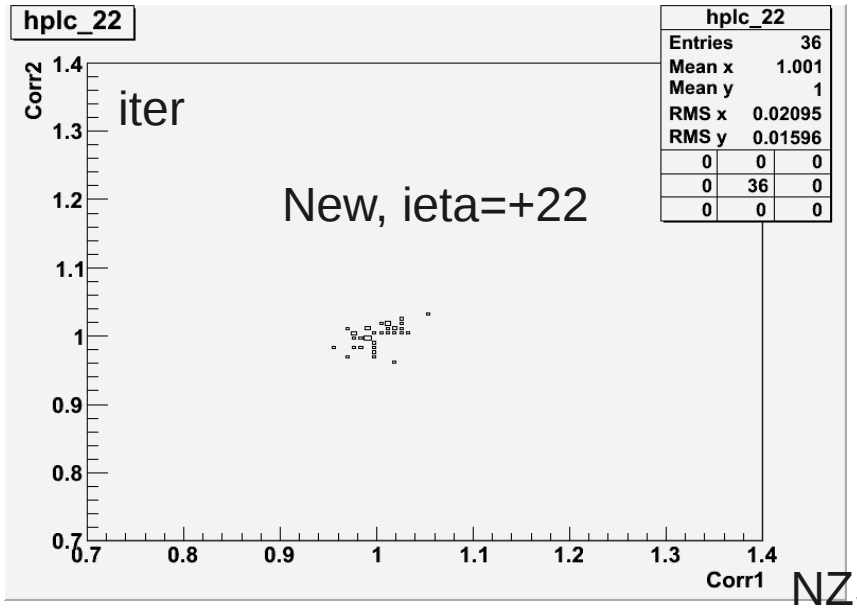


HE, ieta=22



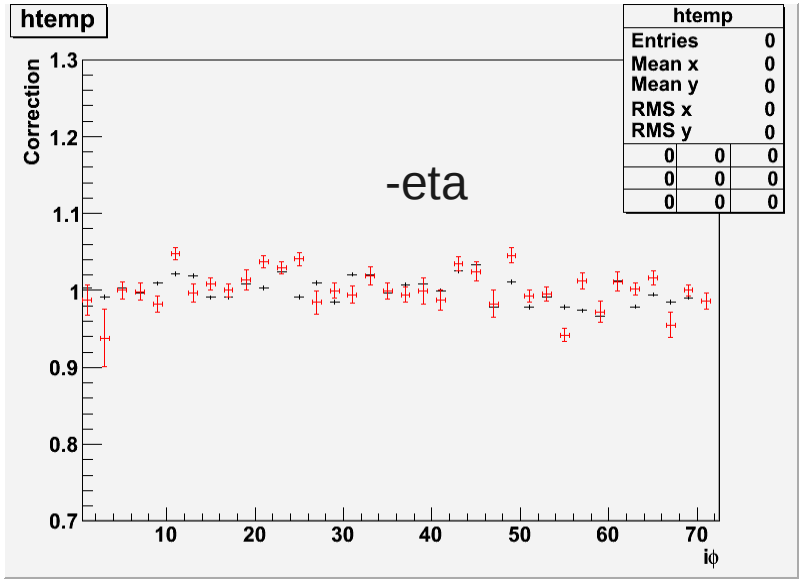






NZS

HE, ieta=23


htemp
Correction
-eta
iϕ
htemp
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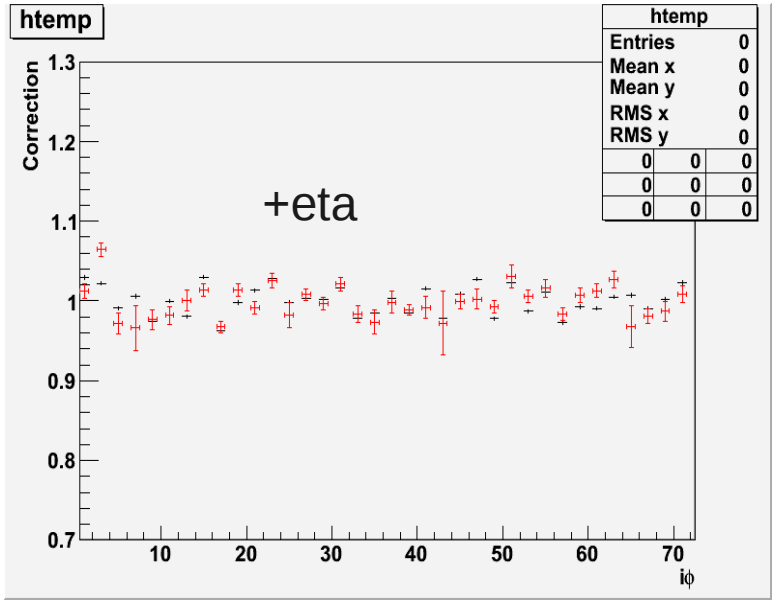
Mean y 0
RMS x 0
RMS y 0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Correction
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iϕ
htemp
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Mean y 0
RMS x 0
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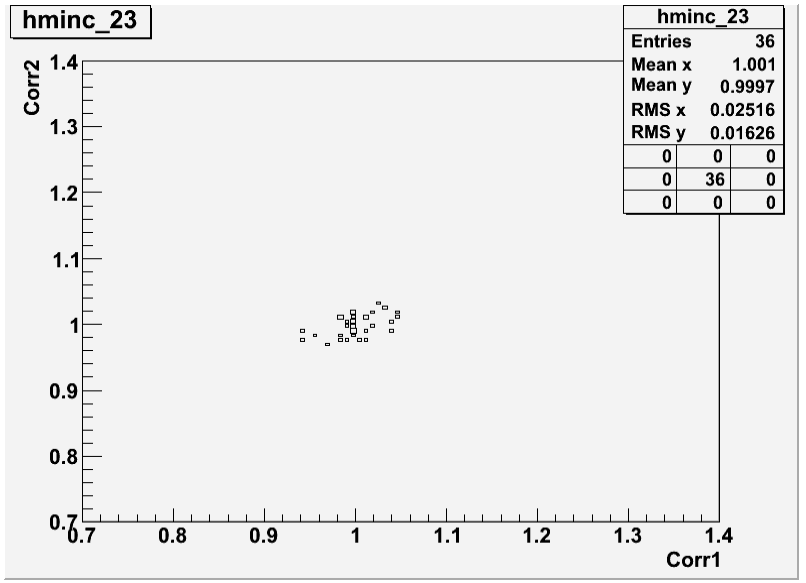
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Corr2
Corr1
hminc_23
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Mean y 0.9997
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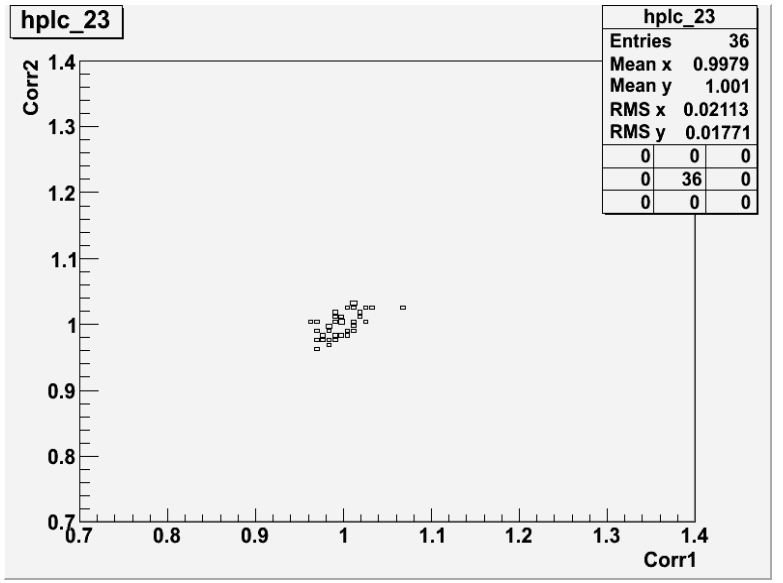
RMS y 0.01626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Corr2
Corr1
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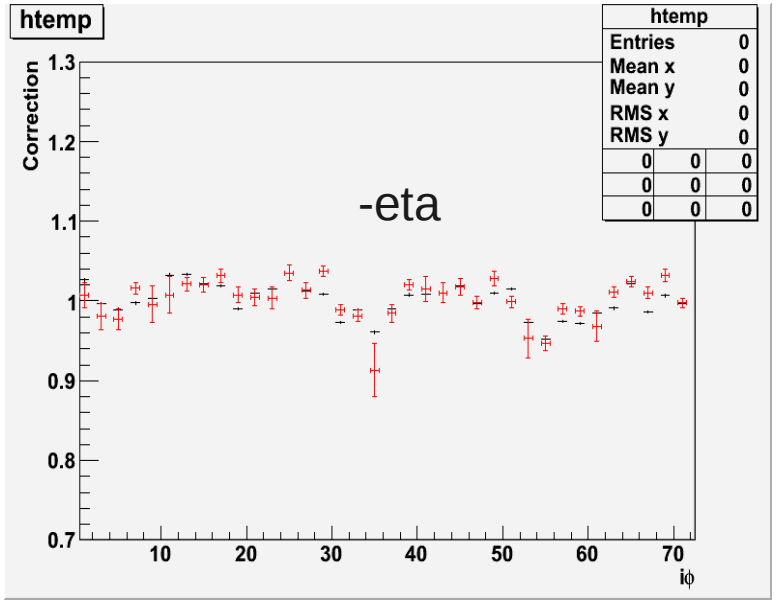
RMS y 0.01771

HE, ieta=25


htemp
Correction
-eta
iϕ
htemp
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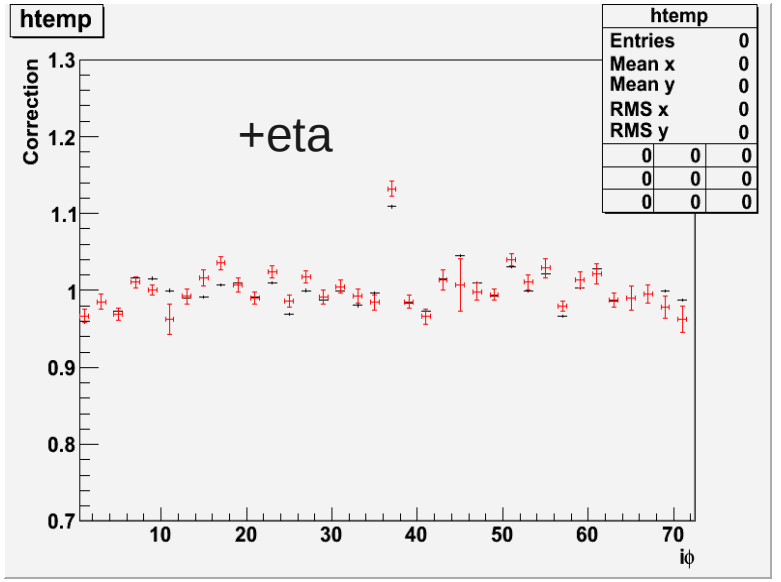
Mean y 0
RMS x 0
RMS y 0


htemp
Correction
+eta
iϕ
htemp
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Mean y 0
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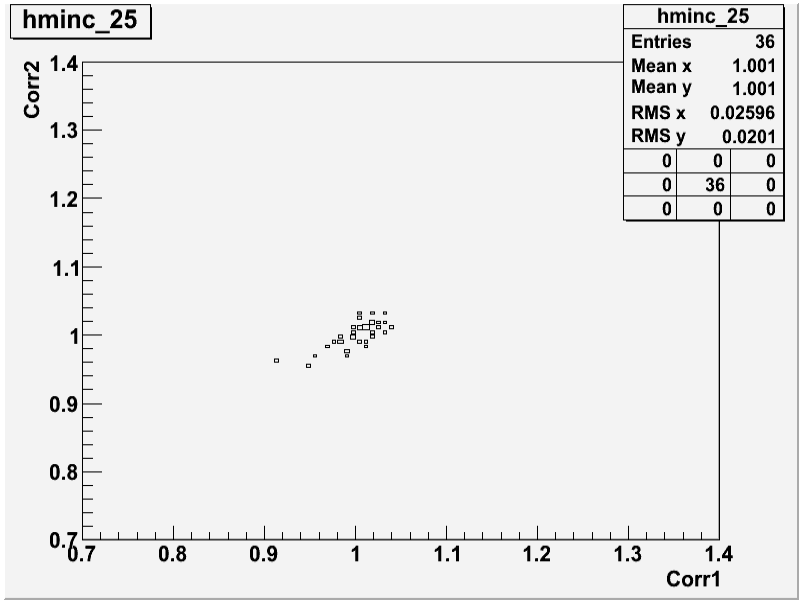
RMS y 0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Corr2
Corr1
hminc_25
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Mean y 1.001
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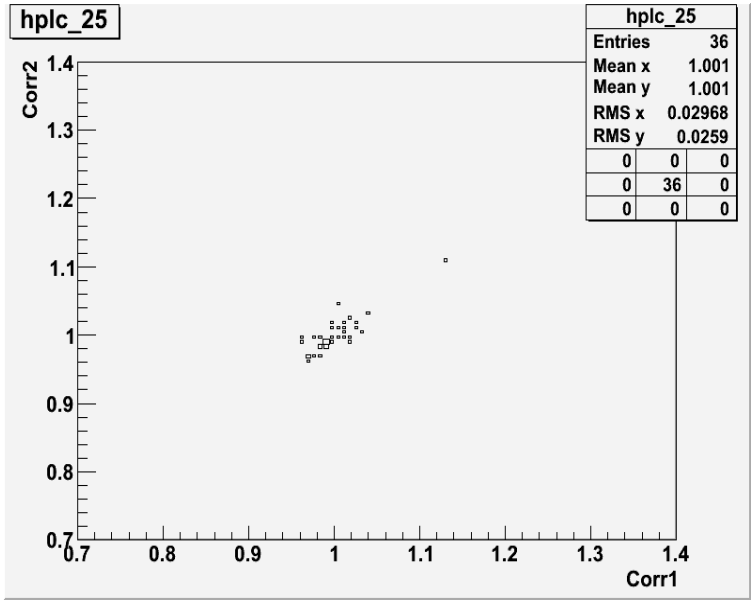
RMS y 0.0201


hplc_25
Corr2
Corr1
hplc_25
Entries 36
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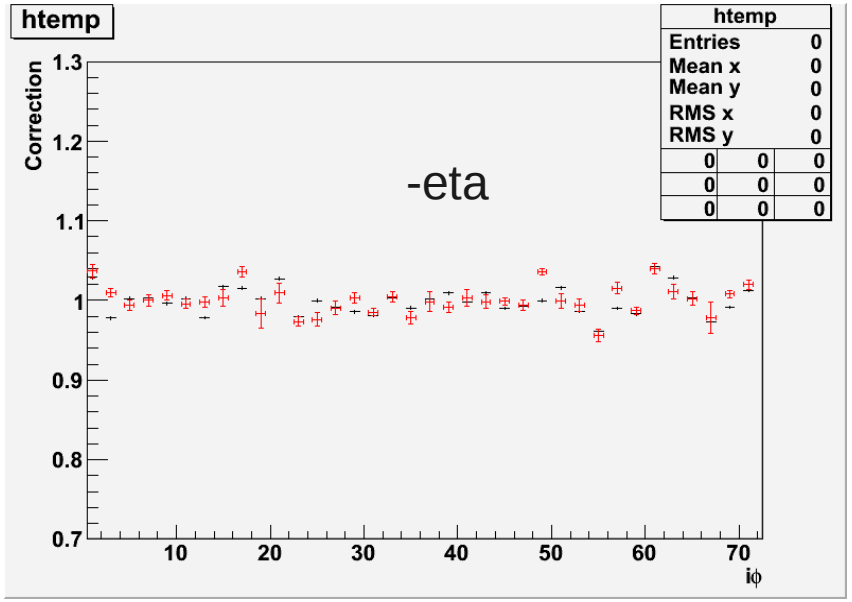
Mean y 1.001
RMS x 0.02968
RMS y 0.0259

HE, ieta=27


htemp
htemp
Entries 0
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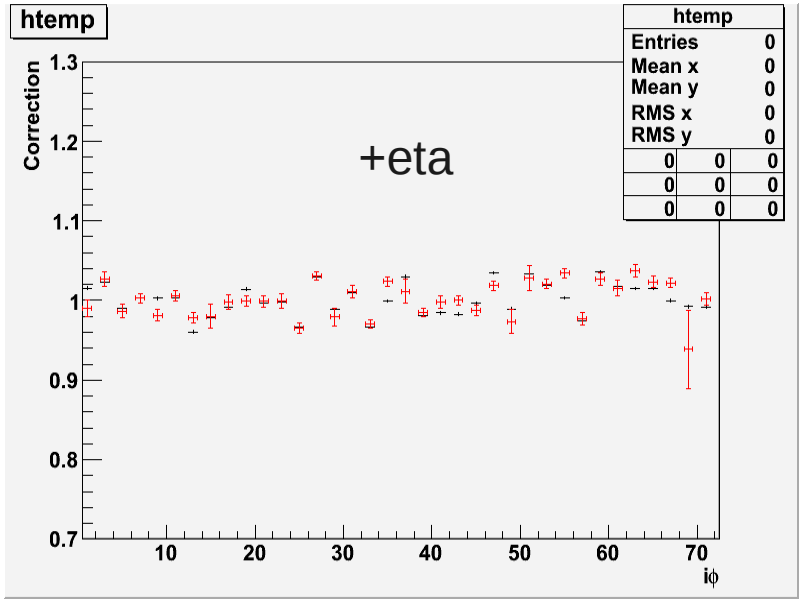
Mean y 0
RMS x 0
RMS y 0
-eta
Correction
iϕ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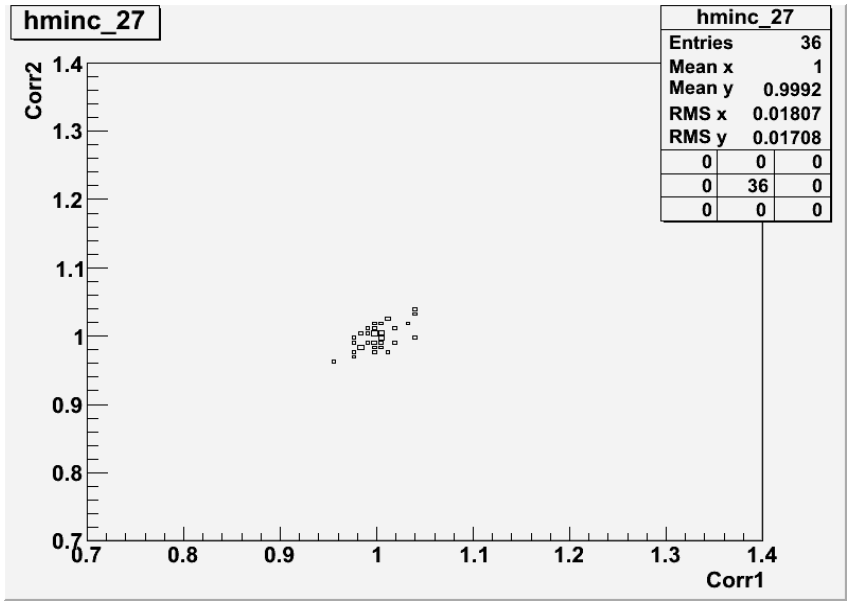
Mean y 0
RMS x 0
RMS y 0
+eta
Correction
iϕ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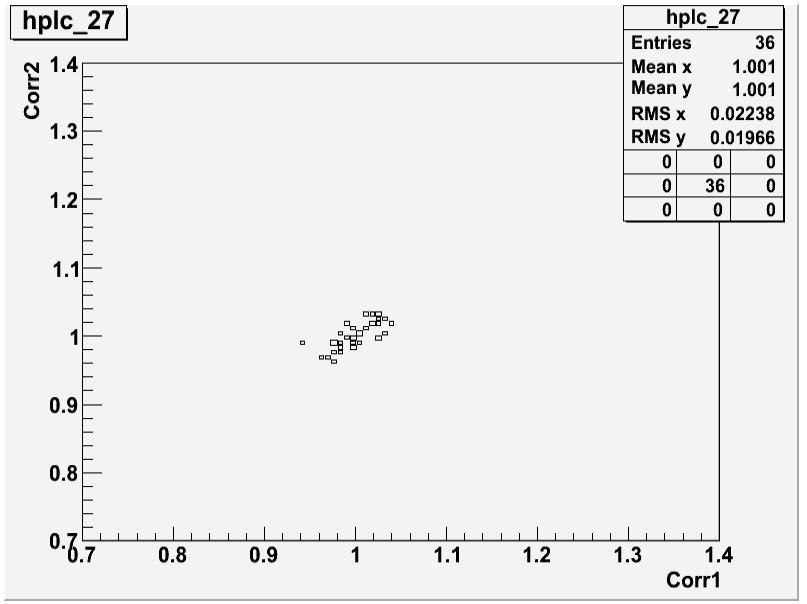
Mean y 0.9992
RMS x 0.01807
RMS y 0.01708
Corr2
Corr1


hplc_27
hplc_27
Entries 36
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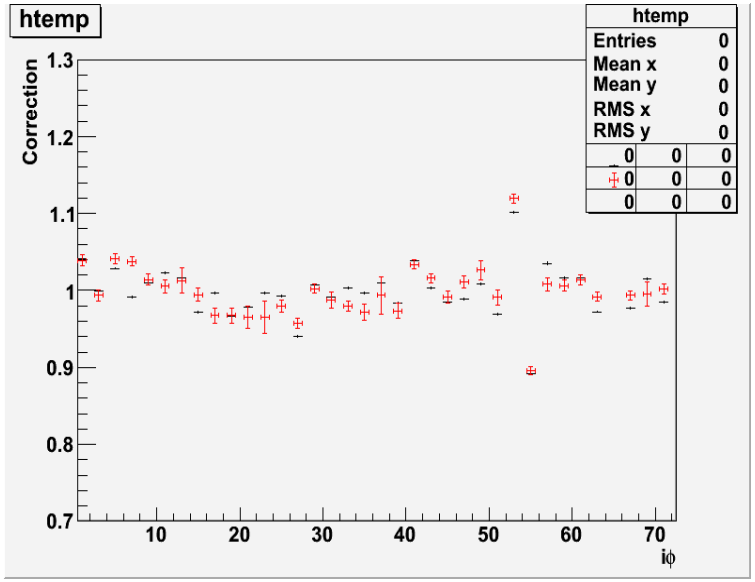
Mean y 1.001
RMS x 0.02238
RMS y 0.01966
Corr2
Corr1

HE, ieta=28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htemp
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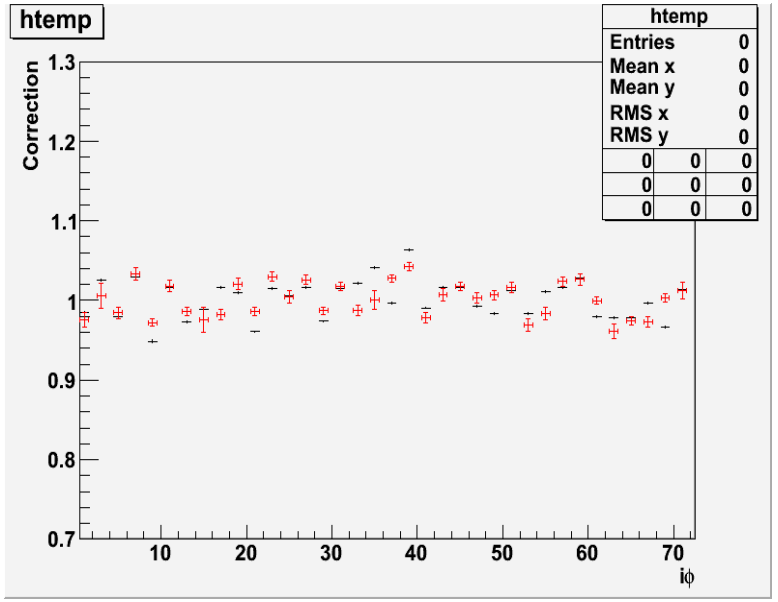
Mean y 0
RMS x 0
RMS y 0
Correction
iϕ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htemp
Entries 0
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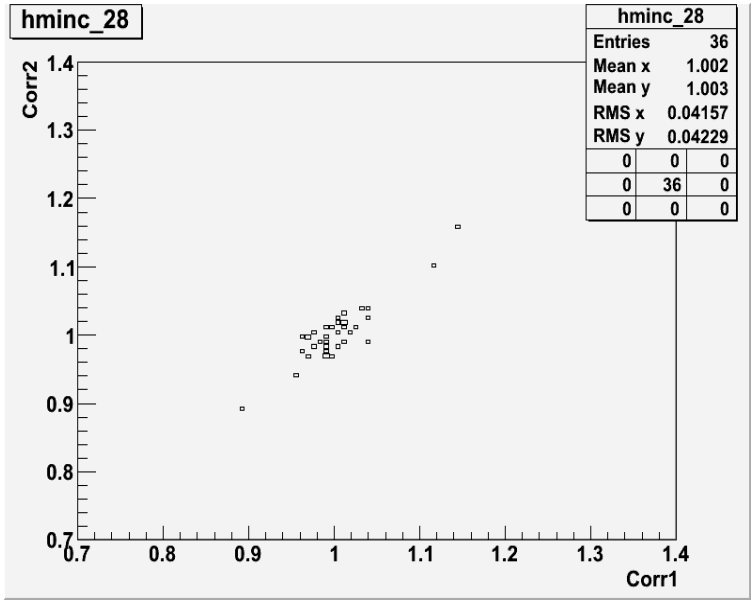
Mean y 0
RMS x 0
RMS y 0
Correction
iϕ


hminc_28
hminc_28
Entries 36
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Mean y 1.003
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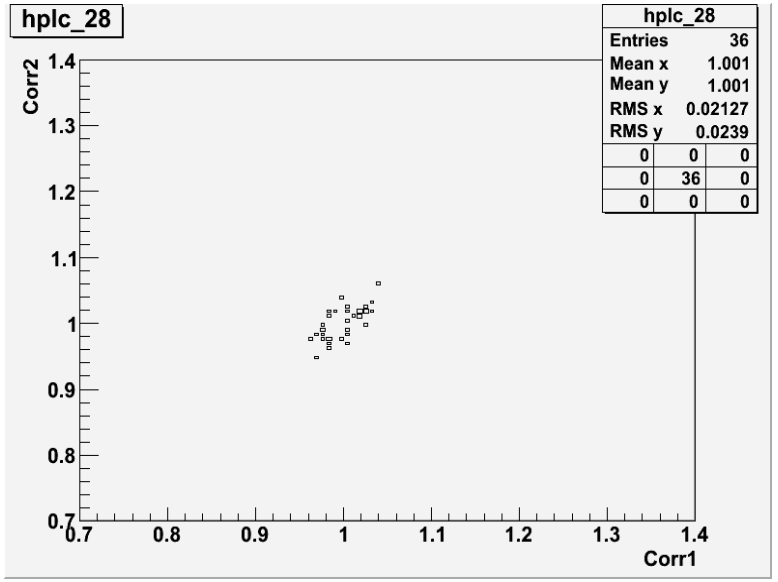
RMS y 0.04229
Corr2
Corr1

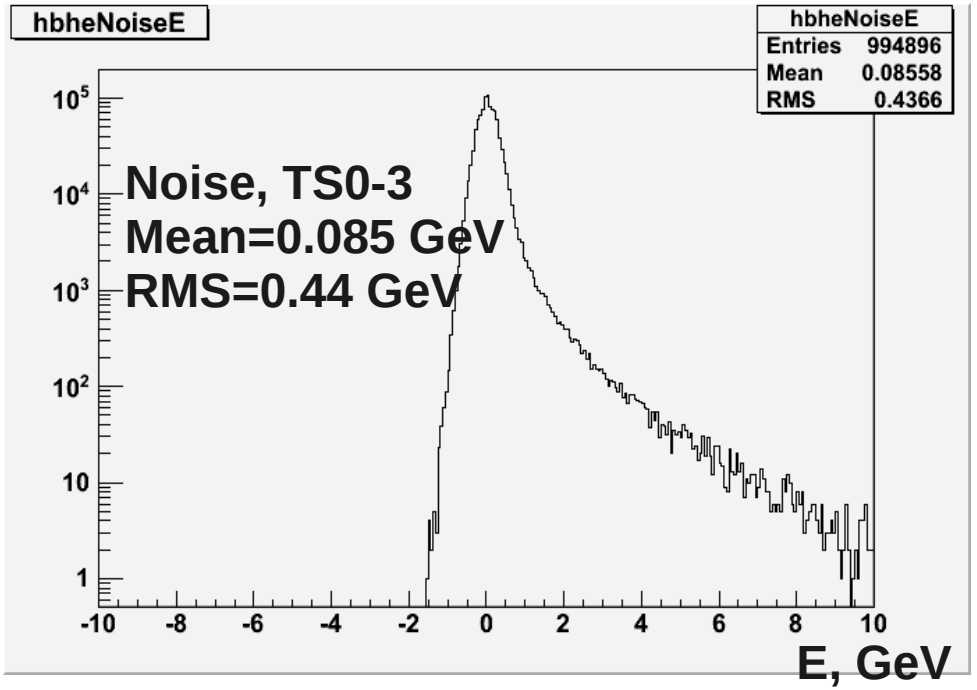

hplc_28
hplc_28
Entries 36
Mean x 1.001
Mean y 1.001
RMS x 0.02127
RMS y 0.0239
Corr2
Corr1

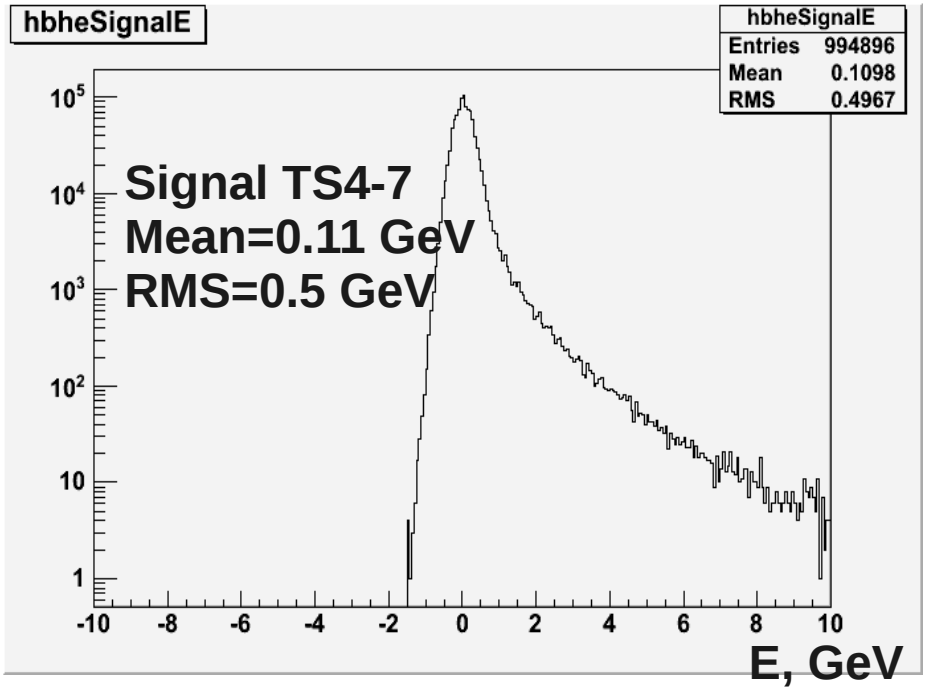
Summary

(1) For ieta>=21 (double size cells) errors of coefficients decreases and the correlation with iterative method start to be visible.

(2) For ieta<21 the situation is much worse. Seems, we need to clean the pedestal sample and remove “bad” events as this sample is not treated by data certification.

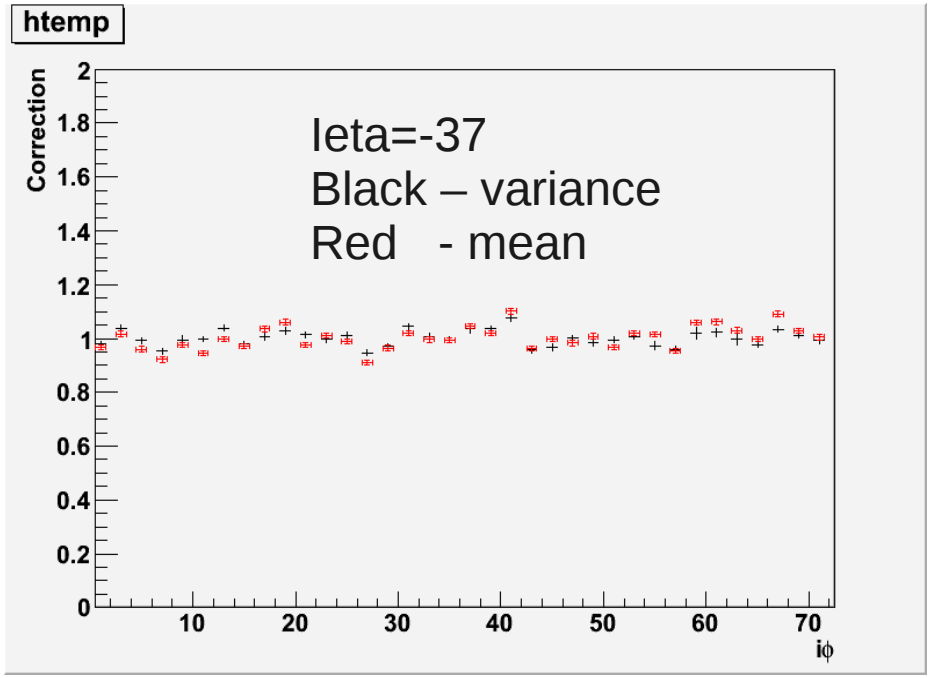
Signal/Noise in HBHE for 50 ns

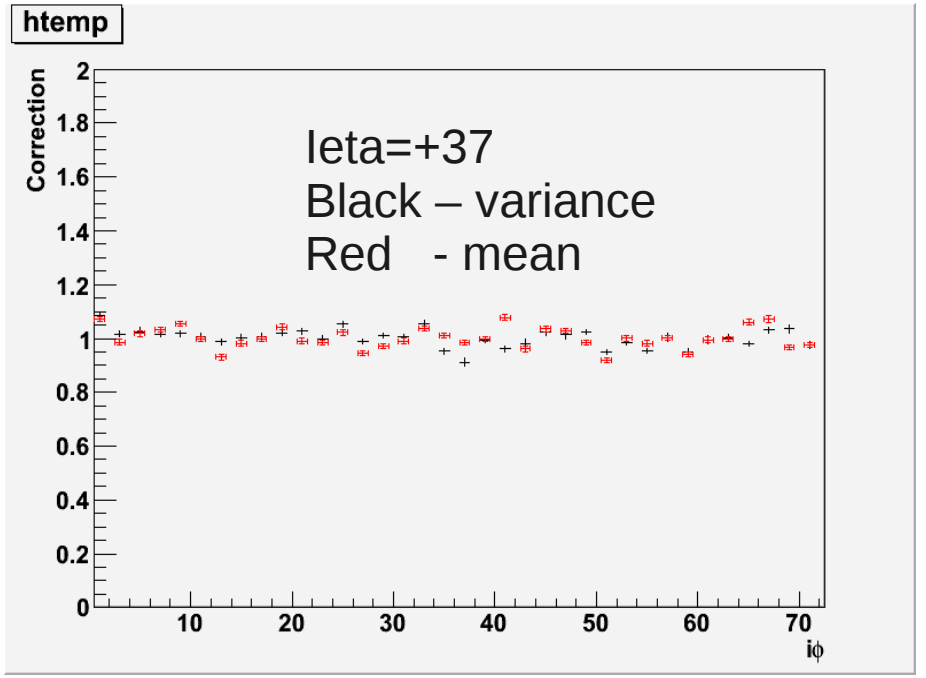




Both Signal and Noise TSs have the mixture of In time and out-of-time pileup. Signal TS accumulate more energy.

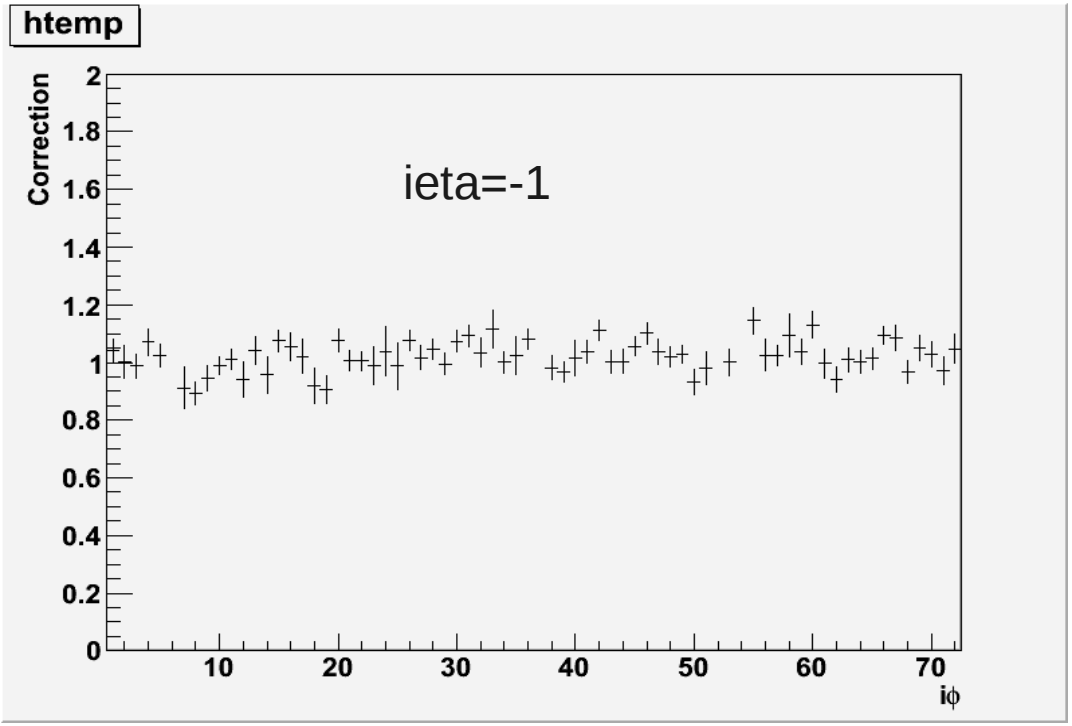
Corrections in HF (mean vs variance)

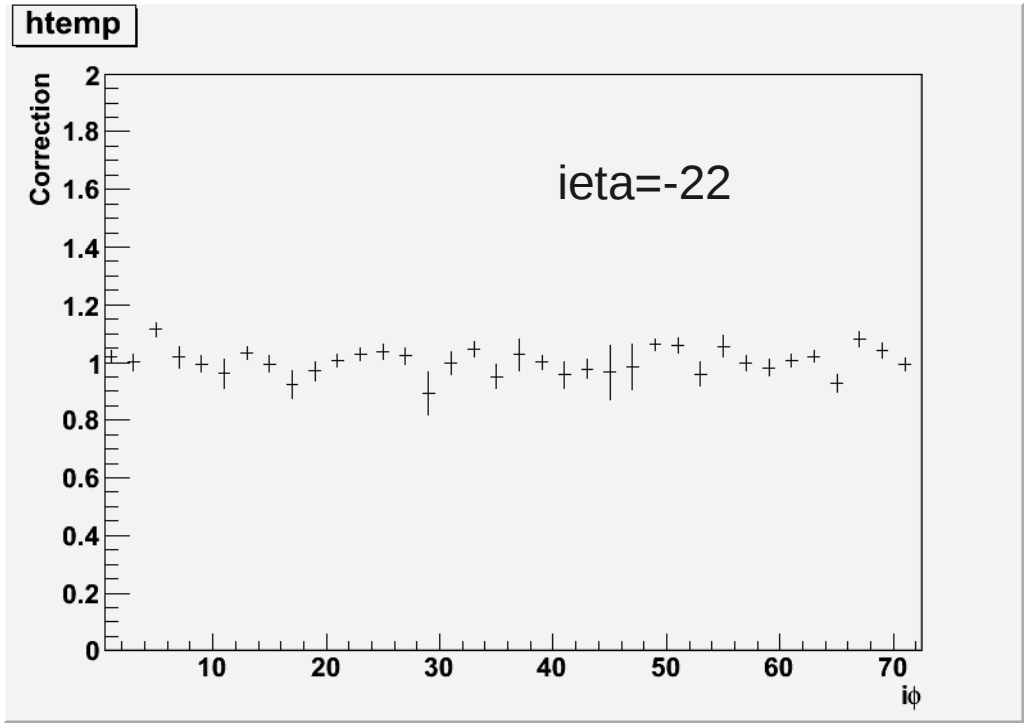




Variance method gives close result to Iterative method (Igor)
Both methods are combined with weighting corresponding to correction error

Corrections in HBHE (mean vs variance)





Only variances

2010 coefficients were done with 3 mlns.
2011: 2 mlns for now. HBHE corrections have large errors > 5%

Summary

HF: we need to re-calibrate after sleeves exchange.
With 2 TS reconstruction, Variance signal > variance noise.
Both methods can be used.

3 mlns give error to HF coefficients <2 %.

For HBHE we need more events

50 ns bunch spacing introduce the additional energy deposition in signal and noise part which has to be taken into account for the needed statistics